

IN THE CLAIMS

Please amend the claims as follows:

Claim 1 (Currently Amended): A dental caries detecting device, comprising:

an ultraviolet light source;

a fluorescence receiving portion that receives fluorescence from a tooth in response to ultraviolet irradiation from the ultraviolet light source;

a fluorescence data analysis portion that analyzes fluorescence data transmitted from the fluorescence receiving portion; and

a data display portion that displays data analyzed by the fluorescence data analysis portion,

said fluorescence data analysis portion analyzing the fluorescence data based on [[the]] fluorescence intensities in at least two wavelength bands in a visible light range, a first wavelength band of the at least two wavelength bands having a wavelength width from 10 nm to 260 nm, and a second wavelength band of the at least two wavelength bands having a wavelength width from 10 nm to 170 nm.

Claim 2 (Currently Amended): A dental caries detecting device, comprising:

an ultraviolet light source;

a fluorescence receiving portion that receives fluorescence from a single measuring area of a tooth in response to ultraviolet irradiation of at least two different light intensities from the ultraviolet light source;

a fluorescence data analysis portion that analyzes fluorescence data transmitted from the fluorescence receiving portion; and

a data display portion that displays data analyzed by the fluorescence data analysis portion,

wherein said fluorescence data analysis portion ~~analyzing~~ analyzes data based on a plurality of fluorescence intensities in at least one wavelength band that changes in response to change in the light intensity of said ultraviolet irradiation.

Claim 3 (Currently Amended): The dental caries detecting device according to claim ~~1 or~~ 2, wherein said fluorescence data analysis portion calculates ~~[[the]]~~ a degree of progress of dental caries based on said fluorescence intensity in a first wavelength band selected in a wavelength band from 550 nm to 810 nm and having a wavelength width from 0.1 nm to 260 nm, and said fluorescence intensity in a second wavelength band selected from a wavelength band from 380 nm to 550 nm and having a wavelength width from 0.1 nm to 170 nm.

Claim 4 (Currently Amended): The dental caries detecting device according to claim ~~1 or~~ 2, wherein said fluorescence data analysis portion calculates ~~[[the]]~~ a degree of progress of dental caries based on said fluorescence intensity in a first wavelength band selected from a wavelength band from 550 nm to 810 nm and having a wavelength width from 0.1 nm to 260 nm, and one or more of said fluorescence intensity in a second wavelength band selected from a wavelength band from 380 nm to 550 nm and having a wavelength width from 0.1 nm to 170 nm and said fluorescence intensity in a third wavelength band selected from a wavelength band from 450 nm to 650 nm and having a wavelength width from 0.1 nm to 200 nm.

Claim 5 (Previously Presented): The dental caries detecting device according to claim 4, wherein said fluorescence receiving portion comprises an optical device that can extract information related to said fluorescence intensity in said first wavelength band and said second and/or third wavelength band from said visible light range.

Claim 6 (Original): The dental caries detecting device according to claim 5, wherein said optical device is one of a spectroscopic luminance meter, a color CCD, a CMOS, or an optical sensor with a color filter for at least two colors.

Claim 7 (Currently Amended): The dental caries detecting device according to claim 6, wherein ~~[[the]]~~ an output intensity of said ultraviolet light source is adjustable.

Claim 8 (Original): The dental caries detecting device according to claim 7, wherein said ultraviolet light source is an ultraviolet LED.

Claim 9 (Currently Amended): A dental caries detecting method that irradiates a measuring area of a tooth with ultraviolet light from a light source and detects a dental caries based on fluorescence from the measuring area, ~~including~~ comprising:

~~a first step of~~ obtaining fluorescence information from said measuring area;

~~a second step of~~ obtaining ~~[[the]]~~ an intensity of said fluorescence in at least two wavelength bands selected from a first wavelength band selected from a wavelength band from 550 nm to 810 nm and having a wavelength width from ~~[[0.1]]~~ 10 nm to 260 nm, a second wavelength band selected from a wavelength band from 380 nm to 550 nm and having a wavelength width from ~~[[0.1]]~~ 10 nm to 170 nm and a third wavelength band selected from a wavelength band from 450 nm to 650 nm and having a wavelength width from ~~[[0.1]]~~ 10 nm to 200 nm based on said obtained fluorescence information; and

~~a third step of~~ carrying out calculation based on said fluorescence intensities and determining ~~[[the]]~~ a presence/absence of dental caries and/or ~~[[the]]~~ a degree of progress of dental caries based on ~~[[the]]~~ a result of said calculation.

Claim 10 (Currently Amended): The dental caries detecting method according to claim 9, wherein said ~~third step~~ carrying out the calculation includes ~~the steps of~~:

~~a step (3.1) of~~ calculating a dental caries degree  $CD_1$  based on the intensity R of fluorescence in said first wavelength band, and the intensity B of fluorescence in said second wavelength band or the intensity G of fluorescence in said third wavelength band according to the following formula (1) or (2):

$$CD_1 = R/B \quad \dots \text{formula (1)}$$

$$CD_1 = R/G \quad \dots \text{formula (2)}$$

~~a step (3.2) of~~ comparing ~~[[the]]~~ a value of said dental caries degree  $CD_1$  and a lower threshold  $E_1$ , wherein the lower threshold  $E_1$  is calculated based on predetermined fluorescence intensities of a plurality of healthy teeth when measuring conditions of the ultraviolet irradiation device and the fluorescence receiving device are determined; and

~~a step (3.3) of~~ determining the presence of the dental caries if the value of said dental caries degree  $CD_1$  is larger than said lower threshold  $E_1$ , and determining the tooth as being healthy if the value of said dental caries degree  $CD_1$  is equal to or smaller than said lower threshold  $E_1$ .

Claim 11 (Currently Amended): The dental caries detecting method according to claim 10, further including:

~~a step (3.4) of~~ comparing the value of said dental caries degree  $CD_1$  and ~~[[the]]~~ an upper threshold  $F_1$  if the presence of the dental caries is determined ~~in said step (3.3)~~; and

~~a step (3.5) of~~ determining ~~[[the]]~~ a presence of severe dental caries if the value of said dental caries degree  $CD_1$  is larger than the upper threshold  $F_1$  and determining ~~[[the]]~~ a

presence of minor dental caries if the value of said dental caries degree  $CD_1$  is equal to or smaller than the upper threshold  $F_1$ .

Claim 12 (Currently Amended): A dental caries detecting method that irradiates a measuring area of a tooth with ultraviolet light from a light source and detects a dental caries based on fluorescence from the measuring area, including comprising:

~~a first step of~~, when there are two said measuring areas, obtaining fluorescence from said measuring areas as first and second information;

~~a second step of~~ obtaining ~~[[said]]~~ fluorescence intensities in at least two wavelength bands selected from a first wavelength band selected from a wavelength band from 550 nm to 810 nm and having a wavelength width from ~~[[0.1]]~~ 10 nm to 260 nm, a second wavelength band selected from a wavelength band from 380 nm to 550 nm and having a wavelength width from ~~[[0.1]]~~ 10 nm to 170 nm, and a third wavelength band selected from a wavelength band from 450 nm to 650 nm and having a wavelength width from ~~[[0.1]]~~ 10 nm to 200 nm based on said first and second information;

~~a third step of~~ calculating a dental caries degree  $CD_2$  based on said fluorescence intensities according to the following formula (3) or (4):

$$CD_2 = |R_n - R_c| \times |B_n - B_c| \quad \dots \text{formula (3) or}$$

$$CD_2 = |R_n - R_c| \times |G_n - G_c| \quad \dots \text{formula (4)}$$

where  $R_n$  is the fluorescence intensity in the first wavelength band in the first information,  $B_n$  is the fluorescence intensity in the second wavelength band in the first information,  $G_n$  is the fluorescence intensity in the third wavelength band in the first information,  $R_c$  is the fluorescence intensity in the first wavelength band in the second information,  $B_c$  is the fluorescence intensity in the second wavelength band in the second information, and  $G_c$  is the fluorescence intensity in the third wavelength band in the second information;

~~a fourth step of~~ comparing the value of said dental caries degree  $CD_2$  and ~~[[the]] a~~  
lower threshold  $E_2$ ; and

~~a fifth step of~~ determining ~~[[the]] a~~ presence of dental caries if ~~[[the]] a~~ value of said dental caries degree  $CD_2$  is larger than the lower threshold  $E_2$ , and determining the tooth as being healthy if ~~[[the]] a~~ value of said dental caries degree  $CD_2$  is equal to or smaller than the lower threshold  $E_2$ .

Claim 13 (Currently Amended): The dental caries detecting method according to claim 12, further including:

~~a step (5.1) of~~ comparing the value of said dental caries degree  $CD_2$  and ~~[[the]] an~~  
upper threshold  $F_2$  if the presence of dental caries is determined ~~in said fifth step~~; and

~~a step (5.2) of~~ determining the presence of severe dental caries if the value of said dental caries degree  $CD_2$  is larger than said upper threshold  $F_2$  and determining the presence of minor dental caries if the value of said dental caries degree  $CD_2$  is equal to or smaller than said upper threshold  $F_2$ .

Claim 14 (Currently Amended): A dental caries detecting method, comprising:

~~that irradiates~~ irradiating a single measuring area of a tooth with ultraviolet light from a light source; ~~and detects dental caries based on fluorescence from the measuring area,~~  
~~including:~~

~~a first step of~~ obtaining fluorescence from said single measuring area for at least two different light intensities of the ultraviolet light from the light source among light intensities  $U_1, U_2, \dots$ , and  $U_n$  where  ~~$U_1 > U_2 > \dots > U_n$~~   $U_1 > U_2 > \dots > U_n$  as first, second, ..., and n-th information, respectively;

~~a second step of~~ obtaining first fluorescence intensities  $R_1$ ,  $B_1$ , and  $G_1$ , second fluorescence intensities  $R_2$ ,  $B_2$ , and  $G_2$ , ..., and n-th fluorescence intensities  $R_n$ ,  $B_n$ , and  $G_n$  of said fluorescence in at least two wavelength bands selected from a first wavelength band selected from a wavelength band from 550 nm to 810 nm and having a wavelength from ~~[[0.1]]~~ 10 nm to 260 nm, a second wavelength band selected from a wavelength band from 380 nm to 550 nm and having a wavelength width from ~~[[0.1]]~~ 10 nm to 170 nm, and a third wavelength band selected from a wavelength band from 450 nm to 650 nm and having a wavelength width from ~~[[0.1]]~~ 10 nm to 200 nm based on said first information, the second information, ..., and the n-th information;

~~a third step of~~ carrying out calculation according to the following formula (5):

$$(R_1 - R_2) + (R_2 - R_3) + \dots + (R_{n-1} - R_n) \quad \dots \text{formula (5)}$$

and

~~a fourth step of~~ determining that there is a possibility of dental caries if ~~[[the]]~~ a sign of a result obtained from formula (5) is positive, and determining that the tooth is healthy if the sign is negative or ~~[[the]]~~ a result is zero.

Claim 15 (Currently Amended): The dental caries detecting method according to claim 14, further including:

~~a step (4.1) of~~ calculating a dental caries degree  $CD_3$  according to the following formula (6) if it is determined ~~in said fourth step~~ that there is a possibility of dental caries,

$$CD_3 = (R_{n-1}/R_n) \times (B_{n-1}/B_n) \quad \dots \text{formula (6)}$$

~~a step (4.2) of~~ comparing ~~[[the]]~~ a value of said dental caries degree  $CD_3$  and an upper threshold  $F_3$ ;

~~a step (4.3) of~~ determining the tooth as being healthy if the value of said dental caries degree  $CD_3$  is equal to or larger than said upper threshold  $F_3$  and determining the presence of

dental caries if the value of said dental caries degree  $CD_3$  is smaller than said upper threshold  $F_3$ .

Claim 16 (Currently Amended): The dental caries detecting method according to claim 15, further including:

~~a step (4.4) of comparing the value of said dental caries degree  $CD_3$  and a lower threshold  $E_3$  if the presence of dental caries is determined in said step (4.3); and~~

~~a step (4.5) of determining that the dental caries is minor if the value of said dental caries degree  $CD_3$  is equal to or larger than said lower threshold  $E_3$ , and determining that the dental caries is severe if the value of said dental caries degree  $CD_3$  is smaller than said lower threshold  $E_3$ .~~

Claim 17 (Currently Amended): The dental caries detecting method according to claim 14, further including:

~~a step (4.1) of calculating a dental caries degree  $CD_4$  according to the following formula (7) if it is determined in said fourth step that there is a possibility of dental caries,~~

$$CD_4 = (R_{n-1}/R_n) \times (G_{n-1}/G_n) \quad \dots \text{formula (7)}$$

~~a step (4.2) of comparing [[the]] a value of said dental caries degree  $CD_4$  and an upper threshold  $F_4$ ; and~~

~~a step (4.3) of determining the tooth as being healthy if the value of said dental caries degree  $CD_4$  is equal to or larger than said upper threshold  $F_4$ , and determining the presence of dental caries if the value of said dental caries degree  $CD_4$  is smaller than said upper threshold  $F_4$ .~~



Claim 18 (Currently Amended): The dental caries detecting method according to claim 17, further including:

~~a step (4.4) of comparing the value of said dental caries degree  $CD_4$  and a lower threshold  $E_4$  if the presence of dental caries is determined in said step (4.3); and~~

~~a step (4.5) of determining that the dental caries is minor if the value of said dental caries degree  $CD_4$  is equal to or larger than said lower threshold  $E_4$  and determining that the dental caries is severe if the value of said dental caries degree  $CD_4$  is smaller than said lower threshold  $E_4$ .~~

Claim 19 (Currently Amended): The dental caries detecting method according to claim 14, further including:

~~a step (4.1) of calculating a dental caries degree  $CD_4$  according to the following formula (8) if it is determined in said fourth step that there is a possibility of dental caries,~~

$$CD_5 = (R_{n-1}/R_n) \times \{(G_{n-1}/G_n) + (B_{n-1}/B_n)\} \quad \dots \text{formula (8)}$$

~~a step (4.2) of comparing [[the]] a value of said dental caries degree  $CD_5$  and an upper threshold  $F_5$ ; and~~

~~a step (4.3) of determining the tooth as being healthy if the value of said dental caries degree  $CD_5$  is equal to or larger than said upper threshold  $F_5$ , and determining the presence of dental caries if the value of said dental caries degree  $CD_5$  is smaller than said upper threshold  $F_5$ .~~

Claim 20 (Currently Amended): The dental caries detecting method according to claim 19, further including:

~~a step (4.4) of comparing the value of said dental caries  $CD_5$  and a lower threshold  $E_5$  if the presence of dental caries is determined; in said step (4.3) and~~

~~a step (4.5)~~ of determining that the dental caries is minor if the value of said dental caries  $CD_5$  is equal to or larger than the lower threshold  $E_5$  and determining that the dental caries is severe if the value of said dental caries degree  $CD_5$  is smaller than said lower threshold  $E_5$ .

Claim 21 (Original): The dental caries detecting method according to any one of claims 14 to 20, wherein said  $n$  is 2.

Claim 22 (Currently Amended): A dental caries detecting ~~program enabling a computer to carry out~~ computer readable medium including computer executable instructions, wherein the instructions, when executed by a processor, cause the processor to perform the dental caries detecting method according to any one of claims 9 to 20.

Claim 23 (Currently Amended): A dental caries detecting method that irradiates a measuring area with ultraviolet light from a light source and detects dental caries based on fluorescence from the measuring area, ~~including~~ comprising:

~~a first step~~ of obtaining fluorescence from said measuring area as first information, second information, ..., and  $n$ -th information for at least two different light intensities of the ultraviolet light from the light source  $U_1, U_2, \dots, \text{and } U_n$  where  $U_1 > U_2 \dots > U_n$ ;

~~a second step~~ of obtaining a first fluorescence intensity  $R_1$ , a second fluorescence intensity  $R_2$ , ..., and an  $n$ -th fluorescence intensity  $R_n$  in a first wavelength band selected from a wavelength band from 550 nm to 810 nm and having a wavelength width from  $[[0.1]]$  10 nm to 260 nm based on said first information, the second information, ..., and the  $n$ -th information;

~~a third step~~ of calculating according to the following formula (5):

$$(R_1 - R_2) + (R_2 - R_3) + \dots + (R_{n-1} - R_n) \dots \text{formula (5)}$$

and

~~a fourth step of~~ determining that there is a possibility of dental caries if ~~[[the]]~~ a sign of a result obtained from formula (5) is positive, and determining that the tooth is healthy if the sign is negative or the result is zero.

Claim 24 (New): The dental caries detecting device according to claim 1, wherein the fluorescence receiving portion includes a UV cut filter configured to block light of less than 400 nm.

Claim 25 (New): The dental caries detecting device according to claim 2, wherein the fluorescence receiving portion includes a UV cut filter configured to block light of less than 400 nm.

Claim 26 (New): The dental caries detecting method according to claim 9, wherein the obtaining the fluorescence information includes utilizing a UV cut filter to block light of less than 400 nm.

Claim 27 (New): The dental caries detecting method according to claim 12, wherein the obtaining the fluorescence includes utilizing a UV cut filter to block light of less than 400 nm.

Claim 28 (New): The dental caries detecting method according to claim 14, wherein the obtaining the fluorescence includes utilizing a UV cut filter to block light of less than 400 nm.

Claim 29 (New): The dental caries detecting method according to claim 23, wherein the obtaining the fluorescence includes utilizing a UV cut filter to block light of less than 400 nm.